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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/559,142

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Moon-kyoon Chun

NEK-0015

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23413 7590 11/26/2008  
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EXAMINER

LISTVOYB, GREGORY

ART UNIT

PAPER NUMBER

1796

NOTIFICATION DATE

DELIVERY MODE

11/26/2008

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptopatentmail@cantorcolburn.com

<b>Office Action Summary</b>	<b>Application No.</b> 10/559,142	<b>Applicant(s)</b> CHUN ET AL.	
	<b>Examiner</b> GREGORY LISTVOYB	<b>Art Unit</b> 1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 September 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11-19, 21, 23 and 24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-19, 21, 23 and 24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 5-8, 12-13, and 23-24 rejected under 35 U.S.C. 103(a) as being unpatentable over Oshida et al (JP publication 06-056921) herein Oshida in combination with Kurokawa (JP publication 2001-329021), herein Kurokawa.

Oshida discloses a method for manufacturing imide-substituted polymer comprising the following steps:

1. Reaction of 60-90%wt of aromatic vinyl monomer (for example, Styrene, lines 0007 and 0009) and 10-40 % wt of unsaturated dicarboxylic anhydride (for instance, maleic, line 0009, meeting newly added limitation of Claim 1) in methyl ethyl ketone at the presence of 0.011% wt initiator (line 0021) at 150C.

Regarding limitation of Claim 1, Oshida discloses that the feeding ratio between vinyl and carboxylic acid monomers is less than 5:1 (see line 0021) based on their weight. Considering that MW of the monomers (MW of Maleic Anhydride is 98, MW of Styrene is 104 and MW of Methylmethacrylate is 102) are close, the corresponding molar ratio is less than 6:1, meeting the newly added limitation of Claim 1.

2. Separation step performed by supplying the polymerized solution discharged from the step (1) into a separator and then removing unreacted monomers and solvent at 200C and 50 Torr (line 0022).

3. Reaction of continuously supplying melt from step (2) into imidization reactor, containing Aniline (line0023)

4. Drying step to remove volatiles.

In reference to a newly added limitation about total residence time of 2-5 hours, Oshida and the Application disclose the same imidization reaction. However, since Oshida discloses a continuous process, compare to The Application's batch one, Oshida does not disclose a residence time of a reaction.

The advantage of batch reaction is that is allows to achieve higher yield. Also, an artisan can choose batch reactor for economical reasons, especially if limited amount of product intended to be produced. Another advantage of the batch process is that it does not require expensive equipment

Therefore, it would have been obvious to a person of ordinary skills of the art to establish a batch process with reaction time to achieve predetermined conversion of the monomer due to higher yield and in order to make a process more economically attractive.

In reference to Claim 24, Oshida discloses weight average molecular weight of 135000 (see Table 1). Note that not Applicant nor Oshida disclose proper determination of MW by GPC, since GPC is a relative method and GPC standards are not disclose (see Spec page 31 and Oshida line 0033). By using PS standards with one detector only relative MW numbers can be obtained. Considering the above arguments and the fact that typically MW numbers obtained in different labs differ by up to 20%, MW of 135000 (Oshida) and 140700 (Application) are indistinguishable for an artisan.

Oshida does not teach that imidization reaction (step 3) takes place at the presence of catalyst.

Kurokawa discloses a multi step method for production of imidized polymer, where imidization step takes place in Metylisobutyl ketone at the presence of triethylamine (Example 1). The catalyst increases the rate of imidization

Therefore, it would have been obvious to a person of ordinary skills in the art to use a solvent and a catalyst in imidization, since catalyst increases the rate of imidization.

Oshida does not teach conversion of unsaturated carboxylic acid is 95% or more

Kurokawa teaches that conversion of unsaturated carboxylic acid is 95% or more (Line 005).

Kurokawa teaches that non-polymerised monomer imidizes, degrading the color of the product and therefore, its organoleptic quality.

Therefore, it would have been obvious to a person of ordinary skills in the art to achieve high conversion of the unsaturated carboxylic acid in order to achieve high quality of the copolymer.

Oshida and Kurokawa do not teach the amount of homopolystyrene.

Kurokawa teaches that MWD of the final polymer is between 2 and 3, which is close to theoretical MWD. It suggests that the polymer is unimodal styrene-maleinate copolymer. In contrast, in case of forming vinyl-based homopolymer, the resulting MWD would be significantly broader than 3.0.

In addition, Specification of the Application discloses the following: "A reaction temperature in the copolymerization step ranges from 80 to 150 °C, and more preferably 90 to 130 °C. If the temperature is lower than 80 °C, it may not be possible to secure a desired conversion and if it exceeds 150 °C, it may not be possible to obtain the desired molecular weight and a relatively large amount of aromatic vinyl homopolymers, particularly polystyrene, may be generated".

In his Examples Kurokawa performs a polymerisation at 85C, which is in the lower end of the polymerization temperature disclosed in the Specification. Thus, Kurokawa's polymerization conditions do not favor homopolymer formation.

Therefore, it would have been obvious to a person of ordinary skills in the art that with reasonable degree of expectation Kurokawa's polymer has the amount of homopolystyrene at level or lower than one of the Application.

Claims 1, 4, 9, 11 and 14-19, 21, 23 rejected under 35 U.S.C. 103(a) as being unpatentable over Kurokawa in combination with Oshida.

Kurokawa discloses a multi step method for production of imidized polymer, where imidization step takes place in Methylisobutyl ketone at the presence of triethylamine (Example 1).

Kurokawa does not teach the amount of homopolystyrene.

Kurokawa teaches that MWD of the final polymer is between 2 and 3, which is close to theoretical MWD. It suggests that the polymer is unimodal styrene-maleinate copolymer. In contrast, in case of forming vinyl-based homopolymer, the resulting MWD would be significantly broader than 3.0.

In addition, Specification of the Application discloses the following: "A reaction temperature in the copolymerization step ranges from 80 to 150 °C, and more preferably 90 to 130 °C. If the temperature is lower than 80 °C, it may not be possible to secure a desired conversion and if it exceeds 150 °C, it may not be possible to obtain the desired molecular weight and a relatively large amount of aromatic vinyl homopolymers, particularly polystyrene, may be generated".

Therefore, it would have been obvious to a person of ordinary skills in the art that with reasonable degree of expectation Kurokawa's polymer have the amount of homopolystyrene at level or lower than one of the Application.

Regarding claim 4, Kurokawa discloses 0.001-1%wt of initiator, which is of 1,1 bis (tert-butyl-peroxy) cyclohexane (see line 0013).

Regarding Claim 9, Kurokawa teaches 60 % wt of Metylisobutyl ketone in the first reaction step.

In reference to claim 11, reaction temperature in the reactor gradually increases from 85 to 140C (Example 1).

In reference to Claim 14, Kurokawa teaches that the molar ratio between maleic anhydride and aniline is within the range of 0.1-0.9 (Example 1).

In reference to claims 15 and 16, Kurokawa teaches that the ratio of triethylamine to aniline is 3/97 (Example 1).

Regarding claim 18 and 19, Kurokawa teaches that imidization takes place at 140C (Example 1) and devolatilization occurs at 310C and 30 torr (Example 1).

Kurokawa does not teach the amount of homopolystyrene.

In his Examples Kurokawa uses reaction temperature of 85C, greatly reducing possibility of polystyrene formation.

In reference to claim 21, since the Kurokawa's reaction conditions are analogous to one in the application, Kurokawa's process completes at the same time as one in the Application (see discussion above).

Kurokawa does not teach a separation step between polymerization and imidization.

Therefore, it would have been obvious to a person of ordinary skills in the art that with reasonable degree of expectation Kurokawa's polymer have the amount of homopolystyrene at level or lower than one of the Application.

Oshida teaches the above separation step. Separation of unreacted monomer and solvent is economically beneficial, since they can be returned into the first step of the process without any additional separation.

Therefore, it would have been obvious to a person of ordinary skills in the art to include a separation step between polymerization in Kurokawa's process, since it provides economically sound process due to recycling unreacted monomer and solvent.

### ***Response to Arguments***

Applicant's arguments filed on 9/09/2008 have been fully considered but they are not persuasive.

Applicant argues that "it is clearly understood from the expressions in the instant specification, especially in the examples of this invention that the polymerization according to the present invention is conducted by continuous process".

This is incorrect. In fact, the claimed method consists of two separate processes (polymerisation of vinyl monomer, imidization and following imidization). It is clear that discharge of the first reactor (copolymerization) takes place only after achieving certain degree of polymerization, i.e. batchwise, but not continuously.

Applicant further argues that "when the polymerization step in Oshida is compared with that of the present invention, Oshida discloses that the polymerization is conducted at 150°C of the polymerization temperature until the polymerization conversion ratio becomes 65% (See [0021] paragraph). Therefore, Oshida does not meet with the limitation of Claim 1 that the polymerization conversion ratio of unsaturated dicarboxylic acid anhydride shall be 95% or more".

This is incorrect. Kurokawa (secondary reference) teaches that conversion of unsaturated carboxylic acid is 95% or more (Line 005).

Applicant argues that the imidization process of Oshida is different from that of the present invention in that the imidization is conducted in a very short time (2-5 minutes) at a very severe condition (high temperature, pressure and shear rate) in an extruder, as described in the specification of this application.

As stated before, Oshida teaches a continuous process, while the Applicant discloses at least partially batch method. The advantage of batch reaction is that it allows to achieve higher yield. Also, an artisan can choose batch reactor for economical reasons, especially if limited amount of product intended to be produced. Another advantage of the batch process is that it does not require expensive equipment (see Kirk-Ottmer encyclopedia of chemical technology, Process design. The nature of chemical process design, vol 0, page 11, 2005, John Wiley and Sons).

Therefore, It would have been obvious to a person of ordinary skills of the art to establish a batch process with reaction time to achieve predetermined conversion of the monomer due to higher yield and in order to make a process more economically attractive.

Regarding Kurokawa, Applicant argues that because the reaction rate of maleic acid anhydride is faster than that of styrene, the conversion ratio of styrene is considerably lower than that of maleic acid anhydride, even though the composition ratio of styrene in the final product is larger than that of maleic acid anhydride. This unbalance due to the difference of reaction rate could be solved by a batch type polymerization (Comparative Example 2), but could not be solved by a general continuous one.

Examiner disagrees. Kurokawa discloses a multi step method for production of imidized polymer, where imidization step takes place in Methylisobutyl ketone at the presence of triethylamine (Example 1).

Regarding newly added limitation that vinyl comonomer conversion is within 67-85% wt., the above value depends on the ratio between the monomers and their relative reactivity. In both Application and Kurokawa's processes the completeness of the synthesis determines by the degree of maleic anhydride conversion, which exceeds 95%. At the same comonomer (Styrene) and close ratios between maleic anhydride and styrene, the conversions of comonomers expected to be close in both Application and Kurokawa's cases.

***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GREGORY LISTVOYB whose telephone number is (571)272-6105. The examiner can normally be reached on 10am-7pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vasu Jagannathan can be reached on 571-272-1119. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1796

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rabon Sergent/  
Primary Examiner, Art Unit 1796

GL